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Applicant : Lawrence Cary Gunn, III
Serial No. : 09/649,969
Filed : August 28, 2000

Art Unit : 2828
Examiner : Philip Nguyen

Title : OPTICAL SYSTEM USING ACTIVE CLADDING LAYER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attached to this facsimile communication cover sheet is a Response (10 pages), faxed this 17th day of June 2004, to the United States Patent and Tradlemark Office.

Respectfully submitted,

Date: June 17, 2004

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Confirmation No.: 8911

Commissioner for Patents
Washington, D.C. 20231

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RESPONSE

In response to the Office Action mailed March 12, 2004 in the above referenced application, Applicant respectfully requests the Patent Office to withdraw each rejection and to allow the application.

Claims 1-3, 5, 7-10, and 16-29 remain pending. No claim has been amended in this response.

Claims 1-3, 5, 7, and 25 stand rejected under 35 USC 112, second paragraph, as allegedly being indefinite for reciting "a microelectronic structure." This contention, however, is respectfully traversed.

Microelectronic structures are well known in the field of electronics, especially in the silicon-based integrated electronics. Such structures can include various electronic components that are small and are generally fabricated on

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silicon semiconductor substrates using various micro fabrication processes such as the photolithographic processes. Some common examples of microelectronic structures include conductors, insulators, resistors, capacitors, inductors, electronic diodes, transistors, and others. The recited "microelectronic structure" in Claims 1-3, 5, 7, and 25, therefore, has well-established meaning and defines a structure that corresponds to any of micro electronic structures in the field of electronics. It is respectfully suggested that "a microelectronic structure" as recited is definite and Claims 1-3, 5, 7, and 25 particularly point out and distinctly claim the invention as described in the original specification.

Claim 1-3, 5, 7-10 and 16-29 stand rejected under 35 USC 103(a) as allegedly being obvious over the '496 patent in view of the '070 patent. Applicants respectfully traverse these rejections because the alleged combination of the '496 patent and the '070 patent fails to disclose or suggest each feature in the pending claims.

Claim 1 recites, among other features, a resonator "formed of a silicon core portion in a silicon material, and a cladding layer surrounding said silicon core portion." Notably, the recited cladding layer in Claim 1 is "made of an optically active material and configured to amplify optical energy that is

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guided in said silicon core portion."

The cited '496 patent is completely silent with respect to the above features of Claim 1. Nothing in the '496 patent suggests the cladding material of the resonator to be made of "an optically active material." As such, the '496 patent fails to disclose the cladding material of the resonator to "amplify optical energy that is guided in said silicon core portion."

The Office Action contends that the '070 patent (Figure 1) fills the voids left by the '496 patent and thus the combination of the '496 and '070 patents would disclose each feature in Claim 1. The disclosure of the '070 patent, however, does not support this contention.

Figure 1 of the '070 patent shows a gain ring cavity 10 formed on a substrate 26. The cavity 10 is "a photonic-wire light emitting device" and hence is optically active and emits light. Figure 2 shows details of the cavity 10 in a cross sectional view along the direction 2-2 as indicated. The cavity 10 includes a relatively high refractive index photonic-wire waveguide core 20 which is surrounded by a relatively low refractive index medium 23 in a width direction of the core 20 and a relatively low refractive medium 33, 35 in a thickness direction of the core 20. Column 5, lines 51-67.

Notably, the relatively low refractive index medium 23 in

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the width direction of the core 20 and the relatively low refractive medium 33, 35 in the thickness direction of the core 20 are optically active and do not amplify or emit light. As such, the '070 patent fails to disclose the recited cladding layer in Claim 1 as being "made of an optically active material and configured to amplify optical energy that is guided in said silicon core portion." Therefore, the combination of the '496 and '070 patents do not disclose or suggest each feature of Claim 1.

In particular, contrary to the statement made in the office action, the '070 patent *teaches away* at least one feature recited in Claim 1. In column 6, lines 41-46, the '070 patent describes the waveguide core 20 in the cavity 10 as follows:

> *The relatively high refractive index photonic-wire waveguide core 20 comprises an optically active excitable medium (hereafter active medium) 30 which can give rise to radiation or absorption of electromagnetic field energy and, in particular, gain or luminescence, when pumped or excited optically or electrically.*

This teaching in the '070 patent *negates* the recited cladding layer in Claim 1 as being "made of an optically active material and configured to amplify optical energy that is guided in said silicon core portion." In Claim 1, the core of the resonator is a silicon core portion and is not an optically active material

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as well known in the art. Therefore, Claim 1 provides a non-conventional resonator with an optically active cladding.

For this reason alone, Claim 1 is distinctly different from the suggested combination of the '496 and '070 patents and is patentable under 35 USC 103(a).

Claim 1 is also patentable over the combination of the '496 and '070 patents on other grounds.

For example, Claim 1 recites the silicon core portion in a silicon material and the silicon material is fabricated to include a microelectronic structure. The '496 and '070 patents fail to disclose, either individually or collectively, the silicon core portion and the microelectronic structure in Claim 1.

In this regard, the '496 patent discloses the core 30 of the resonator 12 to be AlGaAs/GaAs in FIG. 1B and AlGaAs/AlGaAs in FIG. 6 in order to achieve the difference in the indices to provide the desired optical confinement. The core 20 in the '070 patent is described to include the active medium 30 which may be a semiconductor quantum well, quantum wire, or quantum dot formed of materials like InGaAs (Column 6, lines 50-55). The '070 patent uses the quantum materials in the core to provide both optical confinement and optical amplification. Both patents specifically selected these materials to avoid the

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silicon as the core.

Materials like AlGaAs/GaAs and InGaAs are well known for their incompatibility with microelectronic fabrication processes used in silicon-based microelectronic structures such as CMOS processes. Therefore, by virtue of the choices of materials in the '496 and '070 patents, the '496 and '070 patents cannot provide a microelectronic structure made from the same material as the core of the resonator.

Hence, the device recited in Claim 1, by specifically choosing silicon as the core of the resonator, is able to solve the incompatibility issue in the devices in the '496 and '070 patents. As a result, the device recited in Claim 1 is able to have a microelectronic structure fabricated in the same silicon material where the core of the resonator resides. Therefore, Claim 1 provides a single chip solution to a new class of the opto-electronic devices and integrates optical and electronic components- the optical resonator, the optical amplification, and the microelectronic structure in a single chip.

This unique integration platform provided by Claim 1 is possible in part because of the use of the resonator cladding as the active material to produce the optical gain, and in part because of the use of silicon as the core material for the resonator.

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Nothing in the '496 and '070 patents suggests these and other features in Claim 1. The office action fails to find any support in the '496 and '070 patents to support the alleged obviousness. The disclosures of the '496 and '070 patents in fact provide the evidence that Claim 1 is not obvious, is unique, and is distinctly patentable.

The above comparison between Claim 1 and the cited the '496 and '070 patents also suggests that the office action appears to ignore the disclosures made by the cited '496 and '070 patents and use entirely unrelated pieces in the '496 and '070 patents to make up the rejections. For example, the '070 patent teaches the core to be optically active and the cladding to be optically inactive. Despite this teaching, the office action on page 3 alleges that the '070 patent discloses the cladding to be optically active. Apparently, the rejections are based on hindsight and are made without the support of the cited '496 and '070 patents. Under 35 USC 103(a), such rejections are clearly erroneous and must be withdrawn.

For at least the above reason, Claim 1 is patentable over the '496 and '070 patents. Accordingly, dependent Claims 2, 3, 5, 7, and 17-19 are also patentable.

Claims 8-10 are patentable over the alleged combination of the '496 and '070 patents because, as discussed in connection

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with Claim 1, the alleged combination fails to disclose the recited introducing light into an inactive silicon waveguide core of an optical disk shaped resonator which has an optically active waveguide cladding for said inactive silicon waveguide core and the optical pumping of the optically active waveguide cladding to amplify the light guided in said inactive silicon waveguide core in the optical disk shaped resonator.

Claim 16 is patentable over the alleged combination of the '496 and '070 patents because, as discussed in connection with Claim 1, the alleged combination fails to disclose an optical disk shaped resonator formed of an inactive core material surrounded by an active cladding material and a pump laser which drives said active cladding material until lasing occurs in said optical resonator.

Claims 20-24 are patentable over the alleged combination of the '496 and '070 patents because, as discussed in connection with Claim 1, the alleged combination fails to disclose introducing light into an inactive silicon waveguide core of an optical ring resonator which has an optically active waveguide cladding for the inactive silicon waveguide core; the optical pumping of the waveguide cladding to amplify resonant light guided in the optical ring resonator. In addition, the alleged combination of the '496 and '070 patents fails to teach the

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rotation of the optical ring resonator and the measurement of an optical output of the optical ring resonator to determine a rate of rotation of the optical ring resonator.

Finally, Claims 25-29 are patentable over the alleged combination of the '496 and '070 patents because, as discussed in connection with Claim 1, the alleged combination fails to disclose a semiconductor material fabricated to comprise a waveguide core and a microelectronic structure, and the waveguide cladding made of an optically active dielectric material to amplify resonant light guided in said waveguide core.

In view of the above remarks, and further in view of the previous office action and the response filed by Applicants, it appears that the Patent Office has failed its burden to make a prima facie showing of unpatentability. Therefore, Applicants respectfully urge the Patent Office to withdraw all rejections and allow all of the pending claims.

Applicant invites the examiner to call Applicant's attorney, Bing Ai, at (858)678-4327 if a telephonic discussion would facilitate the resolution of the above and any other issues involved in this case.

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Respectfully submitted,

Date: June 17, 2004

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